12-26-00 JC02 Rec'd PCT/PTO 22 DEC 2000

FORM PTO-1390 (Modified) (REV 11-98) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER	
294-92 PCT/US	
U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)	09/720798

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/NL99/00416	02 July 1999	02 July 1998

TITLE OF INVENTION
Salt-Stable Modified Starch

APPLICANT(S) FOR DO/EO/US
Pieter Lykle BUWALDA, Heine Rolf MIEMA and Charles James BRINE

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☒ Certificate of Mailing by Express Mail
20. ☒ Other items or information:

Copy of the PCT application as published under International Publication Number WO 00 01251.
Copy of letter to WIPO dated 22 June 2000 regarding the correct spelling of the name of inventor MIEMA.

PCTUS1/REV03

526 Rec'd PCT/PTO 22 DEC 2000

U.S. APPLICATION NO. (If known, see 37 CFR)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/720798	PCT/NL99/00416	294-92 PCT/US

21. The following fees are submitted:.	CALCULATIONS PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :	
☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1,000.00**	
☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but Internation Search Report prepared by the EPO or JPO **$860.00**	
☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$710.00**	
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$690.00**	
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**	
ENTER APPROPRIATE BASIC FEE AMOUNT =	**$860.00**
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	**$0.00**

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	21 - 20 =	1	x $18.00	**$18.00**
Independent claims	1 - 3 =	0	x $80.00	**$0.00**
Multiple Dependent Claims **(check if applicable)**.			☒	**$270.00**
TOTAL OF ABOVE CALCULATIONS			=	**$1,148.00**
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) **(check if applicable)**.			☐	**$0.00**
SUBTOTAL			=	**$1,148.00**
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).			+	**$0.00**
TOTAL NATIONAL FEE			=	**$1,148.00**
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).**			☐	**$0.00**
TOTAL FEES ENCLOSED			=	**$1,148.00**
			Amount to be: refunded	$
			charged	$

☒ A check in the amount of **$1,148.00** to cover the above fees is enclosed.

☐ Please charge my Deposit Account No. in the amount of to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **08-2461** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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SIGNATURE

Ronald J. Baron
NAME

29,281
REGISTRATION NUMBER

22 December 2000
DATE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Buwalda, et al.

Serial No: 09/720,798

Filing Date: December 22, 2000

For: SALT-STABLE MODIFIED STARCH

Examiner: Unassigned

Group Art Unit: Unassigned

Docket: 294-92 PCT/US

Dated: January 31, 2001

I hereby certify this correspondence is being deposited with the United States Postal Service as first class mail, postpaid in an envelope, addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on January 31 2001

Dated: 01/31/01 Carla M. Bryan

Assistant Commissioner for Patents
Washington, DC 20231

PRELIMINARY AMENDMENT

Sir:

Applicants respectfully submit the following Preliminary Amendment for entry in the above-identified application prior to examination.

IN THE SPECIFICATION:

On page 1, before line 1, please insert --BACKGROUND OF THE INVENTION--.

On page 5, before line 1, please insert --SUMMARY OF THE INVENTION--.

On page 5, line 21, please insert --DETAILED DESCRIPTION OF THE INVENTION--.

IN THE CLAIMS:

Please cancel claims 19 and 20 without prejudice.

Please amend claims 3, 4, 6-9, 12, 14, 16 and 18 as follows:

--3. (Amended) A method according to claim 1[or 2] wherein said starch is a non-cereal starch [containing] consisting essentially of [only] amylopectin molecules.--

--4. (Amended) A method according to [any one of claims] claim 1 [to 3] wherein said starch is derived from a genetically modified plant.--

--6. (Amended) A method according to [any one of claims] claim 1 [to 5] wherein said starch is [a] cross-linked [starch, such as a phosphorus oxytrichloride or sodium trimataphosphate].--

--7. (Amended) A method according to [any one of claims] claim 1 [to 6] wherein said starch is a stabilised starch [, such as a hydroxyalkylated or acelyated starch].--

--8. (Amended) A method according to [any one of claims] claim 1 [to 7] wherein said starch is an instant starch.--

--9. (Amended) A method according to [any one of claims] claim 1 [to 8] wherein said foodstuff comprises at least 0.1(w/w)%, preferably at least 0.5 (w/w)%, more preferably at least 1 (w/w)% of a sodium salt.--

--12. (Amended) A method according to [any one of claims] claim 1 [to 8] wherein said foodstuff comprises at least 0.5 (w/w)%, preferably at least 1 (w/w)% of a milk protein or derivative thereof.--

--14. (Amended) A method according to [any one of claims] claim 1 [to 8] wherein said foodstuff comprises at least 0.5 (w/w)%, preferably at least 1 (w/w)% of a calcium salt.--

--16. (Amended) A method according to [any one of claims] claim 1 [to 8] wherein said foodstuff comprises at least 5 (w/w)%, preferably at least 10 (w/w)%, more preferably at least 20 (w/w)% of a sugar.--

--18. (Amended) A method according to [any one of claims] claim 1 [to 17] wherein said foodstuff is a meat brine.—

Please add new claims 21-42 as follows:

21. A method according to claim 1 wherein said starch is selected from the group consisting of phosphorus oxytrichloride or sodium trimataphosphate.

22. A method according to claim 1 wherein in said starch is selected from the group consisting of hydroxyalkylated or acetylated starch.

23. A modified starch wherein said starch is salt stable.

24. A modified starch according to claim 23 wherein said starch is a non-cereal starch consisting essentially of amylopectin molecules.

25. A modified starch according to claim 23 wherein said starch is derived from a

genetically modified plant.

26. A modified starch according to claim 25 wherein said plant is a potato.

27. A modified starch according to claim 23 wherein said starch is cross-linked.

28. A modified starch according to claim 23 wherein said starch is phosphorus oxytrichloride or sodium trimatophosphate.

29. A modified starch according to claim 23 wherein said starch is stabilised.

30. A modified starch according to claim 23 wherein said starch is hydroxyalkylated or acetylated.

31. A modified starch according to claim 23 wherein said starch is an instant starch.

32. A foodstuff comprising a modified starch according to claim 23.

33. A foodstuff according to claim 32 further comprising at least 0.1(w/w)%, preferably at least 0.5 (w/w)%, more preferably at least 1 (w/w)% of a sodium salt.

34. A foodstuff according to claim 32 wherein said salt is sodium chloride.

35. A foodstuff according to claim 32 wherein said salt is sodium monoglutamate.

36. A foodstuff according to claim 32 further comprising at least 0.5 (w/w)%, preferably at least 1 (w/w)% of a milk protein or derivative thereof.

37. A foodstuff according to claim 36 wherein said milk protein or derivative thereof is caseine.

38. A foodstuff according to claim 32 further comprising at least 0.5 (w/w)%, preferably at least 1 (w/w)% of a calcium salt.

39. A foodstuff according to claim 38 wherein said calcium salt is calcium chloride.

40. A foodstuff according to claim 32 further comprising at least 5 (w/w)%, preferably at least 10 (w/w)%, more preferably at least 20 (w/w)% of a sugar.

41. A foodstuff according to claim 40 wherein said sugar is sucrose.

42. A foodstuff according to claim 1 wherein said foodstuff is a meat brine.

AFTER THE CLAIMS

Please insert, after the claims, on a separate sheet:

ABSTRACT

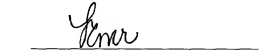
The invention relates to starch used in the food-industry. The invention provides modified starch, and derivatives derived thereof, having improved salt-stability (salt-stable starch), use of such modified starch or derivatives derived from said starch in foodstuff, a method for providing salt-stability to foodstuff comprising use of such modified starch or derivatives derived from said starch and foodstuff comprising said modified starch or derivatives derived from said starch.

For convenience purposes, a copy of the Abstract is attached hereto on a separate sheet.

REMARKS

Applicants have undertaken to amend claims 3, 4, 6-9, 12, 14, 16 and 18 and add new claims 21-42 in the above-identified application in order to remove improper multiple dependencies and conform to U.S. practice. No new matter has been added. In addition, headings and an abstract have been added to the specification. Accordingly, entry hereof and examination on the merits are respectfully requested.

Respectfully submitted,



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ABSTRACT

The invention relates to starch used in the food-industry. The invention provides modified starch, and derivatives derived thereof, having improved salt-stability (salt-stable starch), use of such modified starch or derivatives derived from said starch in foodstuff, a method for providing salt-stability to foodstuff comprising use of such modified starch or derivatives derived from said starch and foodstuff comprising said modified starch or derivatives derived from said starch.

Title: SALT-STABLE MODIFIED STARCH

The invention relates to starch used in the food-industry.

Foodstuff is often thickened by the inclusion of a certain amount of starch as binder, filling or thickening agent, for example providing viscosity to a foodstuff during automated filling (canning).

For example, when industrially autoclaving or sterilising a food-stuff containing solid pieces, a certain filling viscosity is required while a container is being filled to prevent splashing of the liquid content over the rim of the container. Also, said viscosity provides an equal distribution of said solids during the filling phase. In canning, after filling, a decrease of viscosity is required, and any residual viscosity of the foodstuff after filling is considered unwanted for many applications. However, viscosity of starches in general is reduced during or after prolonged heat treatment, said reduction is in general aggravated by the presence of salts in the foodstuff.

Yet another reason to thicken a foodstuff is to provide said food with a better flavour, texture (mouthfeel) and appearance (looks).

Starch in itself has some flavour, that in general is appreciated by a customer, provided the foodstuff does not comprise too much starch which makes it taste starchy or cereal-like and provided a sensation of well-cooked starch is present, as opposed to an "undercooked" starch which gives a raw sensation. Most flavour in food, however, derives from (intricate combinations of) salts, proteins, short peptides, amino acids, fatty acids and salts thereof, sugars, short and medium chain alcohols, and so on.

Texture of a starch comprising food is very much dependent on the degree of viscosity attained by adding varying degrees of starch. Aspects such as smoothness, firmness, cohesiveness, density, thickness, wateriness,

cutability or spreadability, chewability and others can all depend on the viscosity and water retention properties provided by a starch. Too much cohesiveness is in general not appreciated, customers often prefer a more creamy, smooth texture. The choice of type of starch for use in foodstuff is greatly influenced by properties such as the stability during baking, deep-freezing, thawing and storage. It must furthermore be remembered that in general too much starch, although providing a desired viscosity, may change the flavour of the food negatively, in general there is a need to reduce starch dosage whenever this is made possible.

Appearance of a starch comprising foodstuff relates among others to the aspects mentioned with texture, however, starches often add opacity or cloudiness to food, making it look less palatable.

The above illustrates that, within the food industry, use of starch, for each and every different application, often comprises finding the right balance between too little and too much, in trying to find a product with attractive palatability.

A distinct problem herein is the fact that starches in themselves have reduced stability to the effects of certain salts, ions or electrolytes present in food. For example, a starch may initially provide a desired texture (such as smoothness, firmness, cohesiveness, density, thickness, wateriness, cutability or spreadability, chewability) to a foodstuff, which than, however, looses said texture, cohesiveness or smoothness in time because the salt-stability of the starch used is too low or inappropriate. The product becomes watery, falls apart and separates into wet and less wet fractions, leaks flavours, in general looses its appearance and texture, and looses its attraction to a customer. Said loss of texture or appearance is in general caused by a too low stability to sal

ts, electrolytes, cations or anions, or other constituents of food, and necessitates increasing the starch dosage, often with detrimental effects on taste.

The effects of salts on starch have been investigated for more than a century (see for examples: Starch: Chemistry and Technology. Eds. Whistler and Paschall, Academic Press, New York and London).

The gelatinization of starch and starch derivatives in the presence of medium to high concentrations of electrolytes has been studied extensively (B.J. Oosten, Die Staerke 31, 228-230 (1979); B.J. Oosten, Die Staerke 32, 272-275 (1980); B.J. Oosten, Die Staerke 34, 233-239 (1982); B.J. Oosten, Die Staerke 35, 160-169 (1983); B.J. Oosten, Die Staerke 42, 327-330 (1990)). In low concentration systems the properties of solutions of polymers in the presence of electrolytes can be adequately accounted for by electrostatics, taking into account only the magnitude of the ionic charge, the concentration and the solvent. Biological systems are usually more concentrated and specific ion-solvent effects will dominate the solution properties

Some electrolytes promote gelatinization and some electrolytes inhibit the process. Promotion or inhibition mainly follow the well known Hofmeister or lyotropic series (F. Franks in "Water", Royal Society of Chemistry Paperbacks London 1983). This series are a listing of the order in which they affect polymer (and therefor starch) solubility. An example of such a series is:

$$CNS^- > ClO_4^- > I^- > NO_3^- > Cl^- > F^- > HPO_3^{2-} > SO_4^{2-}$$

Electrolytes on the left (CNS^-, ClO_4^-, I^-, NO_2^-) promote and on the right (Cl^-, F^-, HPO_3^{2-}, SO_4^{2-}) inhibit gelatinisation.

This series can of course be extended with other anions and similar series can be listed for cations, although in general the effects observed for cations are smaller than for

anions. A completely satisfying explanation for the observed phenomena for this series has not been reported so far, but the general believe is that electrolytes on the right side enhance water structure thus favouring solvent-solvent interactions over starch-solvent interactions (Franks 1983). This induces a hampered gelatinisation and lack of stability of starches in water.

Neutral components, such as hydrocolloids, ureum, sorbitol, caseine, and sugars such as sucrose, fructose, galactose, and others have similar effects on the stability of starch as salts. It has for example been found that neutral components like saccharides (sugars) effect the viscosity of strach and derivatives (I.D. Evans, D.R. Haisman, Die Staerke 34, 224-231 (1982)). The effects have been contributed to the same phenomena as seen with salts, notably the effects reported on water structure are similar.

The application of starch derivatives in food systems is usually accompanied by the addition of electrolytes, mainly chlorides and phosphates. Especially chlorides and phosphates inhibit the development or stability of viscosity of starch and starch derivatives.

A special case is the addition of calcium ions to potato starch and potato starch derivatives. Potato starch contains bound monophosphate ester groups. In water these phosphate groups give the starch backbone negative charge resulting in a high viscosity as compared to other starches. When calcium ions are added they form a relatively insoluble complex with the phosphate groups resulting in a sharp decrease in viscosity.

Thus, although salt-instability of starch is relatively well understood, the problem remains, starches currently used in the food-industry generally have low-stability to salts compromising at least the palatibility, texture, appearance and other related aspects of foodstuffs.

The invention provides modified starch, and derivatives derived thereof, having improved salt-stability (salt-stable starch), use of such modified starch or derivatives derived from said starch in foodstuff, a method for providing salt-stability to foodstuff comprising use of such modified starch or derivatives derived from said starch and foodstuff comprising said modified starch or derivatives derived from said starch.

The invention provides a method for improving a foodstuff comprising adding to said foodstuff a salt-stable starch. Such a starch has improved stability to salts and other components that are detrimental to the stability of a common starch. The invention for example provides a method for improving the texture of a foodstuff, e.g. the cohesiveness of relatively solid foods such as meats or meat products or puddings or the smoothness of relatively liquid products such as soups, sauces, creams or fillings. The invention provides a method wherein said salt-stable starch is a non-cereal starch, for example derived from tubers or roots, containing essentially only amylopectin molecules.

The invention provides a method for providing a foodstuff with a desired texture comprising adding to said foodstuff a modified starch obtained from for example tubers or roots, said starch containing essentially only amylopectin molecules. A modified starch is a native starch treated in such a way as to modify one or more of its physical or chemical properties. Modified starches have remained their starch character. The native or raw starches are modified to produce starch products with desirable properties. Starches, both of the common variety containing both amylose and amylopectin, obtained from both cereals and tubers or roots and of the waxy variety, containing essentially only amylopectin molecules (e.g. 0-5% amylose), obtained from cereals, are widely used in foodstuff.

Common starch consists of two major components, an, in essence, linear α(1-4)D-glucan polymer (branching is found at a low level) and an elaborately branched α(1-4 and 1-6)D-glucan polymer, called amylose and amylopectin, respectively. Amylose has, in solution, a helical conformation with a molecular weight of 10^4 - 10^5. Amylopectin consists of short chains of α-D-glucopyranose units primarily linked by (1-4) bonds with (1-6) branches and with a molecular weight of up to 10^7.

Amylose/amylopectin ratios in native starches in plants are generally anywhere at 10-40 amylose/90-60% amylopectin, also depending on the variety of plant studied. In a number of plant species mutants are known which deviate significantly from the above mentioned percentages. These mutants have long been known in maize (corn) and some other cereals. Waxy corn or waxy maize has been studied since the beginning of this century. Therefore, the term waxy starch has often been equated with amylose free starch, despite the fact that such starch was in general not known from other starch sources such as potato but mainly derived from corn. Furthermore, industrial use of an amylose free potato starch has never occurred on a large scale and with such a wide range of applications as waxy starch. The invention provides a method according to the invention wherein said starch has superior salt-stability over a common starch. For example, the invention provides a modified cross-linked starch having superior stability over a common starch when tested in a sodium chloride solution, or when tested in a solution containing calcium ions, which seriously effect the viscosity of a common potato starch. Furthermore, the invention provides a cross-linked starch which has superior salt-stability, even at low viscosity, and it's use is thus not dependent on high-viscosity conditions as for example utilised in EP 0796868. Another example of the invention is a modified starch according to the invention which provides a

meat brine, a foodstuff used in preparing meat products, with increased and more stable water binding properties than a common starch would do. Also, the addition of a milk protein, such as caseine which has viscosity inhibiting properties, or derivative thereof to a foodstuff no longer compromises the texture of said foodstuff when a modified starch according to the invention is added to said foodstuff.

The invention provides a method wherein said modified starch containing essentially only amylopectine molecules has been derived from a genetically modified plant. Amylose production in a plant is among others regulated by the enzyme granule-bound starch synthase (GBSS), which is involved in generating the amylose content of starch, and it has been found that many of the waxy cereal mutants described above lack this enzyme or its activity, thereby causing the exclusive amylopectin character of these mutants.

An example of a salt-stable starch provided by the invention is a starch obtained from an amylose-free potato plant which is for example lacking GBSS activity or GBSS protein altogether, thereby lacking amylose and having essentially only amylopectin molecules.

In a preferred embodiment of the invention, a method is provided wherein the starch is derived from a genetically modified plant such as a potato, yam, manihot or cassave. Genetic modification of such tuber or root plants is a skill available to the artisan, and for example involves modification, deletion of or insertion in or (antisense) reversion of (parts of) a gene, such as a gene encoding granule-bound starch synthase (GBSS), which is involved in determining the amylose content of starch. In order to manipulate such crop plants, efficient transformation systems and isolated genes are available, especially of potato, and others are found by analogy. Traits, such as absence of amylose, that are introduced in one variety of a crop plant

can easily be introduced into another variety by cross-breeding.

In the experimental part of this description, a method is provided wherein said modified starch is obtained from a genetically modified potato.

In a preferred embodiment, a method and a modified starch are provided wherein said starch is a crosslinked starch. Crosslinking starch is in itself a method available to the artisan, various cross-linking agents are known, examples are epichlorohydrin, sodium trimetaphosphate, phosphorous oxychloride, chloroacetic acid, acrolein, dichloro acetic acid, adipic anhydride or other reagents with two or more anhydride, halogen, halohydrin, epoxide or glycidyl groups or combinations thereof which all can be used as crosslinking agents. A typical example of such a cross-linked starch is starch mono-phosphate.

Furthermore, the invention provides a starch which is stabilised. Stabilisation by hydroxyalkylation or carboxymethylation of starch is for example obtained with reagents containing a halogen, halohydrin, epoxide or glycidyl group as reactive site. Chloro acetic acid (or its salt) is used as carboxymethylation reagent. In one embodiment of the invention said starch is stabilised by hydroxypropylation, hydroxybutylation, hydroxyethylation and/or carboxymethylation.

In yet another embodiment of the invention, said starch is a stabilized starch in which some or all of the available hydroxyl groups of the amylopectin molecules have been esterified by acetyl groups. The addition of acetyl groups is generally done in aquous suspensions of starch using acetic anhydride or vinyl acetate as reactants under alkaline conditions.

A modified starch as provided by the invention is preferably derived from root or tuber-derived amylose-free or amylopectin native starches such as obtainable from potato

starch, tapioca, sweetroot starch, yam starch, canna starch or manihot starch. In a preferred embodiment of the invention such a root or tuber starch is derived from a genetically modified plant, for example from a genetically modified potato plant variety. Examples of such a potato plant variety are the variety Apriori or Apropect, or varieties derived thereof.

In a much preferred embodiment, the invention provides modified starch comprising a starch obtained from tubers or roots, said starch containing essentially only amylopectin molecules, and derivatives derived thereof, having improved salt-stability (salt-stable starch), use of such modified starch or derivatives derived from said starch in foodstuff, a method for providing salt-stability to foodstuff comprising use of such modified starch or derivatives derived from said starch and foodstuff comprising said modified starch or derivatives derived from said starch.

Use of starch from genetically engineered crops has in general been suggested from the time on it was possible to genetically modify such crops (see i.e. Bruinenberg et al., Chemistry and Industry, 6 November 1995, page 881-884; de Vries, Foodmarketing and Technology, April 1997, page 12-13)). Specific use of amylopectin-type potato starch as filling or viscosity agent in canning has been suggested in WO/97/03573 to prevent undesired residual viscosity seen with commonly used starch. Furthermore, EP 0 796 868 suggests use of a hydroxypropylated and highly cross-linked waxy potato starch to increase the viscosity of a food product. However, none of these provide indications on how to avoid using starches in the food-industry which generally have low-stability to salts and compromise at least the palatibility, texture, appearance and other related aspects of foodstuffs. To the contrary, for example WO/97/03573 suggests an amylopectin-type potato starch which maintains its viscosity only for a certain period, after which no residual viscosity

is left, suggesting that these types of products are less stable instead, and EP 0 796 868 suggests using said hydroxypropylated and highly cross-linked waxy potato starch under conditions of high temperature, low temperature and high shear, again conditions, such as aseptic filing, retorting or freezing, where fill viscosity may be needed and salt stability is no issue.

In a preferred embodiment, the invention provides a method according to the invention wherein said modified starch is an instant starch. In general starch and starch derivatives for the food industry are insoluble in cold water. Viscosity and water binding is achieved by heating or cooking. These starches are referred to as cook-up starches. For convenience starches are sometimes pregelatinised i.e. precooked and dried. These starches are referred to as instant starches and perform without heating or cooking in the food stuff. Pre-gelatinisation can be achieved by spray cooking, spray drying, roll drying, drum drying, extrusion, heating in aqueous water miscible organic solvents or under high pressure or with other methods known in the art.

Furthermore, the invention provides a method wherein said foodstuff comprises at least 0.1(w/w)%, preferably at least 0.5 or 1(w/w)% or even at least 2-10(w/w)% of a sodium salt or combinations of sodium salts, for example wherein said salt comprises sodium chloride or for example wherein said salt comprises sodium-mono-glutamate (vetsin).

Also, the invention provides a method wherein said foodstuff comprises at least 0.5(w/w)%, preferably at least 1 or 2(w/w)% or even at least 10-20(w/w)% of a milk protein or derivative thereof for example wherein said protein is caseine.

Furthermore, the invention provides a method wherein said foodstuff comprises at least 0.5(w/w)%, preferably at least 1(w/w)% or even at least 3-5(w/w)% of a calcium salt, for example wherein said salt is calcium chloride.

Furthermore, the invention provides a method wherein said foodstuff comprises at least 5(w/w)%, preferably at least 10(w/w)%, more preferably at least 20(w/w)% or even at least 30-70(w/w)% of a sugar, for example wherein said sugar is sucrose.

In the experimental part of this description examples are given of improved foodstuffs according to the invention, wherein various salts, and other components, such as milk protein or sugars, or combinations thereof, are used at various concentrations in combination with a starch according to the invention which provides the desired texture to said foodstuff.

Yet another embodiment of the invention is a method wherein said foodstuff is a meat brine, which is a foodstuff in itself (however in general not intended for primary consumption) and used for example for preparing a meat product. Such a meat brine is in general used to improve the texture of a meat product.

The invention further provides a modified starch for use in a method according to the invention. Examples of such a modified starch are described herein above and in the experimental part of the invention.

Furthermore, the invention provides foodstuff obtainable by a method according to the invention. For example, the invention provides a meat brine comprising a modified starch as provided by the invention.

The invention is further described in the experimental part of the description without limiting the invention thereto.

Experimental part

Example 1

Stability of cross-bonded or cross-linked, acetylated regular potato starch (PS), is influenced negatively when applied in salt containing formulations foodstuffs, however, the invention provides products based on amylopectin potato starch (APS) which are more viscosity or water retention stable than regular potato starch derivatives. Especially products that have been developed for meat or meat product applications, such as meat injection brine, used for example for preparing or injecting meats such as ham or poultry products, such as "thanksgiving" turkey. Possible products are regular potato starch derivatives for example crosslinked with sodiumtrimetaphosphate and acetylated with acetic anhydride and are herein compared with amylopectin potato starch (APS) derivatives. APS was crossbonded with the same amount of NaTMP as PS and stabilized with acetic anhydride. The products were characterised on Brabender gelatinisation in demineralised water (*as is*) and in 1% NaCl solution.

Materials

A - Regular potato starch derivative
B - Amylopectin potato starch derivative
C - Regular potato starch derivative
D - Amylopectin potato starch derivative

The crosslinking of A, B, C and D with NaTMP and esterification with acetic anhydride were done according to routine procedures.

E - Regular potato starch derivative
F - Amylopectin potato starch derivative

The crosslinking of E and F with $POCl_3$ was done according to routine procedures.

The products were characterised by Brabender gelatinization. Gelatinisation was measured of a 3% (dry matter) suspension with a Brabender viscograph, type E at 250 cmg in demineralized water. Gelatinisation behaviour was also measured in a 1% NaCl solution.

Table 1 : Brabender gelatinisation, *as is* and in 1% NaCl solution, Brabender type E, 250 cmg, 75 rpm, 3% (dry matter).

Product	Starch	Brabender suspension	Tg °C	Tpeak °C	BUpeak	Brabender BU at °C			
						75°	00'90°	10'90°	20'90°
A	PS	*as is*	59,5	--	--	795	1405	1825	1915
B	APS	*as is*	60,5	73,0	3110	2800	2730	2520	2410
A	PS	1% NaCl	61,5	--	--	35	110	155	175
B	APS	1% NaCl	62,0	--	--	940	1010	1080	1095
C	PS	*as is*	59,5	--	--	805	1335	1710	1800
D	APS	*as is*	64,5	--	--	1515	1735	1805	1820
C	PS	1% NaCl	61,0	--	--	65	145	200	220
D	APS	1% NaCl	66,0	--	--	125	365	1065	1290

PS = Potato starch, APS = Amlopectin potato starch

Viscosity levels in demineralised water of the regular potato starch based products do not differ much. Also it becomes clear that Product D based on APS has the same end viscosity as its potato starch counterpart, but the temperature of gelatinisation is much higher. The product B based on APS has still a peak viscosity. From the table it can be noticed that

the APS based products are more salt stable than the regular PS based products. The end viscosity levels of the samples prepared with potato starch and the APS counterparts do not differ upon gelatinisation in demineralised water. Product B and D. based on amylopectin potato starch provide better stability in the salt solution than the samples prepared with regular potato starch and can therefor be used at lower concentrations.

In table 2, similar effects of $POCl_3$ cross-linked starch ethers are shown.

Table 2. Brookfield viscosity of the products E and F as is and in 1% NaCl solution Broookfield : RVDV II+ #5, 50 rpm

Product	Starch	Crossl.	Amount per kg	Subst.	DS	Solution	Viscosity mPas
E	PS	$POCl_3$	19.5 μL	HP	0.15	*as is*	6150
F	APS	$POCl_3$	19.5 μL	HP	0.15	*as is*	4400
E	PS	$POCl_3$	19.5 μL	HP	0.15	1% NaCl	1960
F	APS	$POCl_3$	19.5 μL	HP	0.15	1% NaCl	2450

Reduction in viscosity of regular potato starch derivative: 70%

Reduction in viscosity of Amylopectin potato starch: 40%

Viscosity of regular starch derivative in water (*as is*) is higher than APS derivative. In salt solution the reverse is observed.

Example 2

Viscosity measurement of cross-linked instant starch derivatives in deionized water, 5%(w/w) sodium casein solution and 1%(w/w) $CaCl_2$ solution

Weight 10 gram of the product. Add 212 ml of the desired solution while the mixture is stirred by hand. Then the mixture is stirred for 1 minute using a Ultra-Turrax at a speed of 4000 rpm. After 29 minutes the dispersion is again stirred by hand for ½ minute and then the viscosity is measured using a Brookfield LVF at 6 rpm with spindle no. 4. Viscosity is determined for increasing degree of cross-linking. For results compare, figures 1, 3, 4.

Example 3

Viscosity measurement of instant starch derivatives in the presence of milk powder.

Weigh 10 gram product and 28 gram milk powder. Add 212 ml de-ionised water while the mixture is stirred by hand. Then the mixture is stirred for 1 minute using a Ultra-Turrax at a speed of 4000 rpm. After 29 minutes the dispersion is again stirred by hand for ½ minute and then the viscosity is measured using a Brookfield LVF at 6 rpm with spindle no. 4. Viscosity is determined for increasing degree of cross-linking. For results compare, figures 1, 2.

Example 4

Water binding

Meat injection brines are injected into whole muscle meats. They provide a desired texture to the meat by dissolving meat proteins that coagulate upon heating. Starch is used to bind water in order to increase the 'pump level' (the amount of water incorporated in the meat product) and texture of the product. They also play a preserving role because of the salt content of the brine. In these experiments water is used to

replace meat, in order to get a realistic approximation of the content of the different ingredients. The ingredients of the meat injection brine are as follows:

demineralised water	480 g
salt	8 g
starch	5.5 g
dextrose	4 g
sodium phosphate	2.5 g

The water binding capacity of the brine is measured as follows. The ingredients are mixed and put in a Brabender viskograph. The initial temperature of the Brabender is set on 30°C, the mixture is heated till 75°C with a slope of 1.5°C/min. After staying 5 min at 75°C, the temperature decreases till 25° with a slope of 3°C/min. The mixture is removed from the Brabender and 400 ml is transferred into 2 transparent centrifuge tubes and centrifuged for 15 min at 894 g and 25°C. The separation line between the pellet and the sediment and the supernatant is marked and hereafter the tubes are emptied and dried. Then the tubes are filled with water till the mark; the weight of the water is the sediment volume. The water binding capacity can be expressed in ml sediment per g starch.

At least two repeats of each starch sample are done. The standard deviation is 5 ml sediment/500 ml on average, which is reasonable compared to a mean of 78 ml sediment/500 ml.

In Figure 5 the water binding of three cross-bonded hydroxypropylated derivatives is shown. The water binding is expressed in ml per g of starch. Farinex VA 15 is a product based on regular potato starch, HW 3294 is a product based amylopectin potato starch and B 990 is a product based on maize starch. The grey bars on the left are the water binding

capacities in demineralised water, the black bars on the right are the capacities in brine.
As can be seen from the figure, in demineralised water the binding capacity of the products based on potato starch and amylopectin potato starch are about the same. The water binding capacity of the product based on maize starch is much lower.

In brine the binding capacity of the amylopectin based derivative is essentially the same as in water. Only a drop of less than 9 % in the binding capacity is observed. The potato based (30 %) and the corn based products (23 %) show a much larger drop in water binding capacity.

Example 6

Viscosity measurements of starch derivatives in the presence of sugar.
It has been found that neutral components like saccharides (sugars) affect the viscosity of starch and derivatives (I,D. Evans, D.R. Haisman, Die staerke 34, 224-231 (1982)). The effects have been contributed to the same phenomena as with salts (water structure).
Example 6 provides the effects on viscosity of using APS derived starch in sugar solutions.

Addition of relatively large amounts of sucrose to common starch causes a decrease in viscosity. Quite surprisingly, amylopectin potato starch derivatives show the opposite effect, as is demonstrated in table 3.

Table 3.

Product	Starch	Brab. susp.	TG	Tpeak	Bupeak	Brabender BU at °C		
						75°	00'90°	20'90°
A	PS	as is	59.5	--	--	795	1405	1915
B	APS	as is	0.5	73.0	3110	2800	2730	2410
A	PS	30% sucr.	61.5	--		360	920	1320
B	APS	30% sucr.	63.0	73	4960	4800	3920	3520

Example 7

Moisture loss of sausages upon refrigerated storage

Bologna sausages were stored in refrigeration at minus 5.5 degrees Centigrade for a week. The sausages were weighed before and after storage, from this the moisture loss was calculated.

In the recipe for the sausage 4 types of starch were used:
- Farinex VA15 a crosslinked, acytelated potato starch (sodium trimetaphosphate, acetic acid anhydride)
- Amylo VA15 a crosslinked, acytelated amylopectin potato starch (sodium trimetaphosphate, acetic acid anhydride)
- Perfectabind M10 a crosslinked, hydroxypropylated potato starch (POC13, propylene oxyde)
- Amylo M10 a crosslinked, hydroxypropylated amylopectin potato starch (POC13 Propylene oxyde)

Recipe of the Bologna sausage:

Lean beef	44.7%
Fat beef	11.2%
Water	34.4%
Salt	2.0%
Sodium tripolyphosphate	0.3%
Sugar	1.7%
Milwalkee seasoning S79608	2.3%
Nitrite (150 ppm)	0.14%
Starch	3.3%

Preperation of the Bologna sausage:
The beef was ground and mixed with water, the ingredients except the starch were added and mixed again, starch was added, mixed again untill a homogeneous mass was obtained. This was emulsified and putt into Bologna sausage casings. Subsequently the sausages were smoked in a smokehouse.

Table 4.
Moisture loss of Bologna sausages after refrigeration for 1 week

Type of starch	moisture loss*
Farinex VA15	2.0%
Amylo VA15	1.5%
Perfectabind M10	3.8%
Amylo M10	1.8%

* These figures are averages of 6 individual sausages per type of starch.

Examples of improved foodstuff according to the invention.

Instant fruit filling

Ingredients:	%	g
Instant modified starch	33.3	15.0
Powdered sugar	66.7	30.0

Preparation procedure:
- the dry ingredients are blended
- the powdered mix (45 g) is added to 200 ml fruit juice and stirred (low speed) for 1 minute.

Instant lemon whipped dessert

Ingredients:	%
Powdered sugar	32.0
Instant skimmed milk powder	22.2
Whippable Fat Powder	22.0
Starch derivative	22.0
Lemon Flavour	1.0
Citric acid	0.5
Colour	0.3

Use 50 g dry mix to 150 mL of cold water

Fat-free bologna

Recipe for fat-free bologna

Ingredients:	%
Lean port (1.2% - 1.5% fat)	28.55
Lean turkey (0.7% fat)	24.37
Water	27.30
Modified starch	7.62
Dextrose	3.13
Salt	2.12
Milk protein hydrolysate	2.06
Bologna flavouring/seasoning	1.79
Sodium lactate	1.25
Turkey stock (dry)	0.38
Sodium tripolyphosphate	0.25
Cure-all (6.25% of $NaNO_2$)	0.12

Low-fat hot dogs

Ingredients:	%
B90 Lean Beef	39.17
B65 Fat Beef	9.36
Water	1.27
Salt	2.05
Sodium Tripolyphosphate (TSP)	0.243
Sucrose	1.69
Beef Frankfurter Seasoning	2.20
Cure salt (contains 6.25% sodium nitrite)	0.121
Sodium Erythorbate	0.022
Ground Mustard	0.58
Modified starch	3.38
Total raw meat mix:	100.0

Vending soup

Ingredients:	%	g
Instant modified starch	2.6	5.5
Bouillon powder	1.9	4.0
Water	95.5	200.0

Preparation procedure:
- weigh the dry components in a 250 ml beaker
- add hot water and stir

Instant pudding

Ingredients:	%	g
Instant modified starch	24.2	20.0
Powdered sugar	48.5	40.0
Dextrose monohydrate	24.2	20.0
Tetrasodium pyrophosphate	2.0	1.8
Calcium acetate	1.0	0.8
Colour/vanilla flavour	0.1	0.4

Preparation procedure:
- the dry ingredients are blended
- the powdered mix (80 g) is added to 500 ml cold milk and stirred for 1 minute using an electric hand-mixer (high speed)
- pour the pudding into dessert-trays and place them into the refrigerator for 30 minutes

Bilberry pie filling

Ingredients:		%	g
A	sugar	19.0	47.5
	modified starch	5.4	13.5
	salt	0.2	0.5
B	bilberry juice	30.0	75.0
	water	45.4	113.5
Total:		100.0	250.0

Preparation procedure:
- mix the dry components (mix A)
- mix bilberry juice and water in a pan (mix B)
- add mix A to mix B and suspend with a whisk
- heat until boiling whilst stirring with a wisk
- keep boiling for 1 minute

UHT lobster soup

Ingredients:	%
Milk	12.1
Cream	6.0
Lobstermix**	5.1
Lecimulthin 100*	0.02
Instant modified starch	4.3
Water	72.48

* Supplier Lucas Meyer
** Supplier Rieber & Son

Processing steps for lobster soup:
- Preheating to 70°C in a PHE
- Homgenisation at 50 bar
- Sterilisation at 135°C
- Holding for 28 seconds
- Cooling to 20°C in tubes (20 QC heb ik veranderd in °C)
- Filling temperature 20°C

Recipe UHT spicy soup

Ingredients:	%
Salt (NaCl)	0.8
Butter	0.6
Tomato paste	12.5
Instant modified starch	2.0
Spice mix	0.8
Chicken bouillon	0.2
Lecimulthin 100*	0.03
Water	83.07

* Supplier Lucas Meyer

Processing steps for tomato soup:
- Preheating to 70°C in a PHE
- Homgenisation at 50 bar
- Sterilisation at 135°C
- Holding for 28 seconds
- Cooling to 20°C in tubes
- Filling temperature 20°C

Instant bakery cream

Ingredients:	%	g
Instant modified starch	20.0	80.0
Whole milk powder	30.0	120.0
Powdered sugar	47.5	130.0
Alginate blend	2.25	20.0
Colour/vanilla flavour	0.25	1.0

Preparation procedure:
- the dry ingredients are blended
- the powdered mix (400 g) is added to 1000 ml tap water and stirred for 3 minutes using an Hobart mixer (high speed)

Hot dogs and bologna (low fat formulation 15%)

Meal formulation for	50Lbs
Ingredients %	
B85 Lean Beef	44.740%
B50 Fat Beef	11.180%
Water	34.380%
Salt	2.030%
Sodium Tripolyphosphate	0.280%
Sucrose	1.692%
Seasoning Milwaukee*	2.280%
Nitrite (150 PPM)	0.140%
Sod Erythorbate (550 PPM of	0.000%
Starch	3.288%
Total	99.997%

Figures

Figure 1. Viscosity measurement of cross-linked instant starch derivatives in deionized water.

Figure 2. Viscosity measurement of cross-linked instant starch derivatives in a milky solution, here prepared by adding milk powder.

Figure 3. Viscosity measurement of cross-linked instant starch derivatives in 1%(w/w) $CaCl_2$ solution.

Figure 4. Viscosity measurement of cross-linked instant starch derivatives in 5%(w/w) sodium casein solution.

Figure 5. Water binding properties of cross-linked hydroxylpropylated starch derivatives in water and in brine.

CLAIMS

1. A method for improving a foodstuff comprising adding to said foodstuff a salt-stable starch.

2. A method according to claim 1 wherein the texture of said foodstuff is improved.

3. A method according to claim 1 or 2 wherein said starch is a non-cereal starch containing essentially only amylopectin molecules.

4. A method according to any one of claims 1 to 3 wherein said starch is derived from a genetically modified plant.

5. A method according to claim 4 wherein said plant is a potato.

6. A method according to any one of claims 1 to 5 wherein said starch is a cross-linked starch, such as a phosphorus oxytrichloride or sodium trimataphoshate cross-linked starch.

7. A method according to any one of claims 1 to 6 wherein said starch is a stabilised starch, such as a hydroxyalkylated or acetylated starch.

8. A method according to any one of claims 1 to 7 wherein said starch is an instant starch.

9. A method according to any one of claims 1 to 8 wherein said foodstuff comprises at least 0.1(w/w)%, preferably at least 0.5 (w/w)%, more preferably at least 1 (w/w)% of a sodium salt.

10. A method according to claim 9 wherein said salt is sodium chloride.

11. A method according to claim 9 wherein said salt is sodium monoglutamate.

12. A method according to any one of claims 1 to 8 wherein said foodstuff comprises at least 0.5(w/w)%, preferably at least 1(w/w)% of a milk protein or derivative thereof.

13. A method according to claim 12 wherein said protein is caseine.

14. A method according to any one of claims 1 to 8 wherein said foodstuff comprises at least 0.5(w/w)%, preferably at least 1(w/w)% of a calcium salt.

15. A method according to claim 14 wherein said salt is calcium chloride.

16. A method according to any one of claims 1 to 8 wherein said foodstuff comprises at least 5(w/w)%, preferably at least 10(w/w)%, more preferably at least 20(w/w)% of a sugar.

17. A method according to claim 16 wherein said sugar is sucrose.

18. A method according to any one of claims 1 to 17 wherein said foodstuff is a meat brine.

19. A modified starch for use in a method according to any one of claims 1 to 18.

20. A foodstuff obtainable by a method according to any one of claims 1 to 18.

Figure 1 : Brookfield viscosity in deionized water
Brookfield LVF, 6 rpm, spindle 4

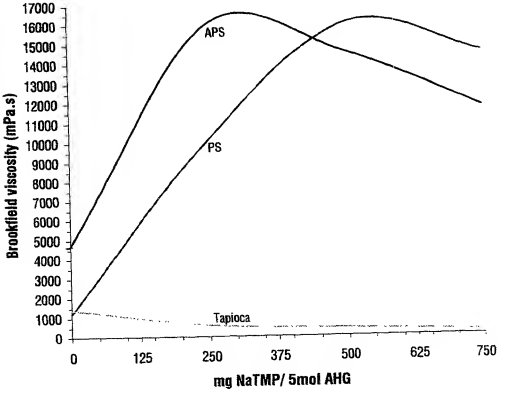


Figure 2 : Brookfield viscosity in milk
Brookfield LVF, 6 rpm, spindle 4

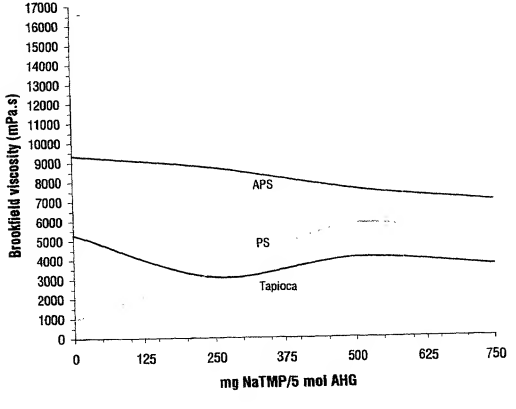


Figure 3 : Brookfield viscosity in 1% $CaCl_2$
Brookfield LVF, 6 rpm, spindle 4

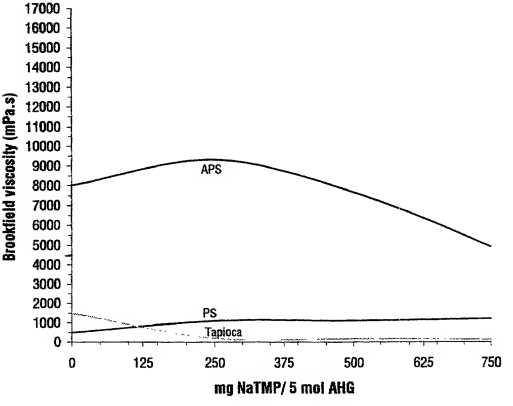


Figure 4 : Brookfield viscosity in 5 % Caseine (Sodium salt)
Brookfield LVF, 6 rpm, spindle 4

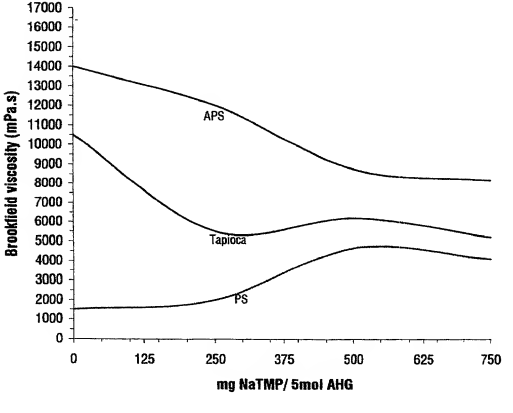
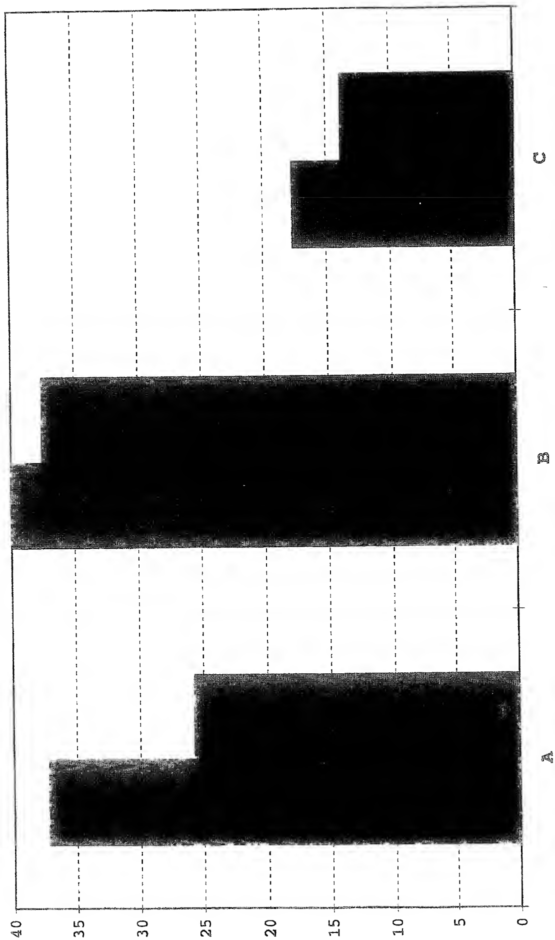


Figure 5

Left, water; right, brine



Declaration and Power of Attorney Patent Application (Design or Utility)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: "Salt-Stable Modified Starch".

the specification of which

☐ is attached hereto

x was filed on December 22, 2000 as application serial no. and or PCT International Application number PCT/NL99/00416 and was amended on (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information know to me to be material to patentability as defined in 37 C.F.R.§1.56.

I hereby claim foreign priority benefits under 35 U.S.C.§119(a)-(d) or 35 U.S.C.§365(b) of any foreign application(s) for patent or inventor's certificate, or 35 U.S.C.§365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate of PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)		
Number 98202232.9	**Country** EP	**Day/Month/Year Filed** 2 July 1998
Number	**Country**	**Day/Month/Year Filed**
Number	**Country**	**Day/Month/Year Filed**

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

Prior Provisional Application(s)	
Serial Number	**Day/Month/Year Filing Date**
Serial Number	**Day/Month/Year Filing Date**
Serial Number	**Day/Month/Year Filing Date**

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s), or under 35 U.S.C. §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in 37 C.F.R.§1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

Prior U.S. or International Application(s)		
Serial Number	**Day/Month/Year Filed**	**Status** (patented, pending, abandoned)
Serial Number	**Day/Month/Year Filed**	**Status** (patented, pending, abandoned)
Serial Number	**Day/Month/Year Filed**	**Status** (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C.§1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Power of Attorney

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

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I hereby authorize them or others whom they may appoint to act and rely on instructions from and communicate directly with the person/organization who/which first sends this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instructed otherwise.

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